CHAPTER I

INTRODUCTION

A. Background

Mathematical proof is a formal and logical line of reasoning that begin

with a set of axioms and moves through logical steps to a conclusion. Varghese

(2009) noted that proof is a tool to derive, verify, find, explain, and reason

logically about a statement. Proof as a deductive argument for a mathematical

statement is crucial ability in advanced mathematical thinking.

Proof has an important role in mathematics because of its ability in

demonstrating and explaining the truth value of some prepositions (Ko and

Knuth, 2009; Solow, 1982; Tiro and Sabri, 2012; Tsamir et.al. in Guler, 2016).

Besides that, proof can show the meaning in a statement such that its ideas can

be connected into a new idea (Martin and Harel, 1989). Interestingly, proof is

intellectual challenge that can sharpen thinking skill (Solow, 1982; Tiro and

Sabri, 2012; Tsamiret, et.al. in Guler, 2016). Besides that, writing proof records

the understanding to communicate mathematical ideas with others (Solow, 1982;

Tiro and Sabri, 2012). Accordingly, mathematics students should have and

develop their skills in writing proof (Blanton et.al in Weber, 2004; Guler, 2016;

Ko and Knuth, 2009; NCT in Kartini and Suanto, 2015; Santosa, 2013).

In college, proof is one of the indicators of the understanding of

undergraduates about matter that they have learnt. However, based on several

studies, most undergraduates say that mathematical proof is hard (Harel in

Findell, 2001; Pfeiffer in Abdussakir, 2014; Weber, 2004). Besides that, some

undergraduates are ignorant of the need to give a mathematical proof to verify a

statement (Alibert in Cabassut et.al., 2012; Carpenter et.al. in Cabassut et.al.,

2012; Guler, 2016; Moore in Santosa, 2013). Whereas according to Stylianou,

Blanton, and Rotou (2015), there is a correlation between students belief of the

important of a topic with their successful in mathematics learning.

Abstract algebra is one of subjects in mathematics whose the competence

of the undergraduates is measured by their ability in solving a problem and

constructing a proof (Findell, 2001; Selden dan Selden 2007). The reason of the

statement before is the matter in abstract algebra is related to the definition,

axiom, lemma, theorem, and corollary (Abdussakir, 2014). In the currriculum of

mathematics departement of FMIPA UNM, abstract algebra is divided into two

subjects, they are introduction and intermediate. The introduction of abstract

algebra contains group theory and the intermediate of abstract algebra contains

ring.

There are 22 undergraduates of mathematics program in mathematics

department FMIPA UNM who have programmed introduction of abstract

algebra subject. From the interval 0 to 100, the achievement of undergraduates

for their final exam is one student got 15, four students got 17.5, three students

got 22.5, five students got 25, five students got 27.5, one student got 30, one

student got 35, one student got 40, and the last student got 42.5. If we convert

the result in score, then eight students got C-, eleven students got C, and three

students got C+. The data show that the scores of the students are low.

Based on the result of observation for the undergraduates of mathematics

study program in FMIPA UNM, proofs in abstract algebra are very hard for

them. The major reason for the difficulty of abstract algebra is the form of

problem in that subject that is in proof form, whereas proof is hard for them.

Proof is a new matter for them and has not been learnt in school before. Besides

that, they are hard for comprehending the given definitions and theorems

because abstract algebra is too abstract as its name. Problems in abstract algebra

are very miscellaneous so they have trouble in using the previous problem to

solve the newer problem.

The difficulty of proof in abstract algebra brings some errors for

undergraduates of pure mathematics study program in FMIPA UNM.

Undergraduates are hard to use the theorems which they have learnt before and

sometimes they confuse to distinguish between existential and universal

quantifiers. Not only that, when proving a bi-conditional statement, the

undergraduates often only prove one direction. It is also hard for undergraduates

to write their ideas completely.

We need a deeper analysis about undergraduates’ capability in proving,

especially their errors and misconceptions. Therefore a study entitle

Undergraduates’ Errors Analysis in Proving the Propositions in Abstract Algebra

(A Case Study for Undergraduates of Mathematics Department of FMIPA

UNM) will be conducted.

B. Research Question

Based on the background above, this study will be guided by a research

question, namely: “What are the errors of undergraduates’ proofs in abstract

algebra?”

C. Research Objective

By this research, we will reach the analysis of the errors of

undergraduates’ proofs in abstract algebra.

D. Research Significances

1. Theoretical Significance

This study gives contribution as knowledge about the errors and

misconceptions of undergraduates’ proofs in abstract algebra.

2. Practical Significance

This study is important for the lecturers to know about the errors and

misconceptions of undergraduates’ proofs in abstract algebra. It also can be

a base for developing the study about proof. As the last, it can be a reference

for further relevant research and development. Furthermore, this analysis

may be useful in guiding mathematics educators when designing transition-

to-proof or proof-based mathematics courses such as abstract algebra or real

analysis

E. Terms Limitation

For preventing different interpretation for some terms used in this study,

the definitions of some terms are limited as follows:

1. Errors in this study are the missing in arranging proof’s steps and applying

mathematical concepts, especially based on knowledge dimensions, namely

factual, conceptual, procedural, and metacognitive.

2. Proof is an explanation of the truth of a proposition by some logical

reasoning. In this study, proof is limited at a formal mathematics proof.

3. Proposition is a mathematical statement that will be proved.

4. Abstract algebra is a subject containing the topics of introduction of abstract

algebra, specifically group theory. There are some matters learnt in this

subject, such as groups and their properties, subgroup, normal subgroup,

quotient groups, and homomorphism.